I CLAIM:

1. A process for enriching LNG in methane, comprising the steps:

a) feeding an initial LNG stream to a heat exchanger wherein the LNG stream partially vaporizes,

b) feeding the partially vaporized initial LNG stream into a middle region of a distillation column that has a concentration section and a stripping 7
section,

c) operating the distillation column to separate the partially vaporized initial LNG stream into a methane enriched overhead gas stream and into an ethane enriched liquid product stream,

d) warming the methane enriched gas stream,

e) compressing the warmed methane enriched gas stream, and cooling the compressed methane enriched gas stream to a temperature at or near ambient,

f) further cooling the compressed and cooled methane enriched gas stream to liquid state,

g) and distributing the compressed and liquefied methane enriched gas stream into two streams, one of which is expanded and then introduced to the top

of the distillation column as a reflux, and the other of which is expanded and provided as a methane product.

2. The process of claim 1 wherein step a) includes pumping the initial LNG from a storage region to said heat exchanger.

3. The process of claim 1 wherein said ethane enriched liquid stream is removed from an intermediate tray in the distillation column, and wherein a propane-butane enriched bottom liquid is produced in the distillation column, as a propane-butane product.

4. The method of claim 1 wherein the fluid pressure in the distillation column is between 15 and 72 psia; and wherein a compressor is employed to compress the methane enriched gas stream in step e), the compressor having a discharge pressure between 58 and 174 psia.

5. The method of claim 1 wherein the fluid pressure in the distillation column is between 72-174 psia; an upper a compressor is employed to compress the methane enriched gas stream in step e), the compressor having a discharge pressure between 174 and 363 psia.

6. The method of claim 1 wherein the step g) expansions are throttling processes, which are controlled to thereby control the relative flow distributions of said two streams.

7. The process of claim 1 wherein the composition of the initial LNG is about 0.3% of nitrogen, about 85.8% of methane, about 9.6% of ethane, about 3% of propane, about 1% of i-butane, about 0.3% of total i-pentane and n-hexane; the composition of the methane product is about 0.34% of nitrogen, about 98% of methane, about 1.7% of ethane; and the composition of the ethane product is about 65.5% of ethane, about 24.1% of propane, about 8% of i-butane, about 2.4% of total i-pentane and n-hexane.

8. The process of claim 7 wherein the fluid pressure in the distillation column is 6 bara (87 psia), the compressor discharge pressure is 15 bara (217 psia); the vapor mole fraction of the partially vaporized initial LNG at introduction to the distillation column is 0.84%; the number of theoretical trays in the distillation column is 12, including 4 trays in the tower upper section, and 8 trays in the tower lower section.

9. The process of claim 3 wherein the composition of the ethane product is about 1.3% of methane, about 75.8% of ethane, about 21.9% of propane, about 1% of i-butane; the composition of the propane-butane product is about 0.2% of ethane, about 34.5% or propane, about 49% of i-butane, about 16.3% of total i-pentane and n-hexane; the number of theoretical trays in the distillation column is 12, including 4 trays in the tower upper section, 3 trays in the tower middle section, and 5 trays in the tower lower section.

10. The process of claim 1 wherein fluid pressure in the distillation column is about 1.2 bara (17 psia), the compressor discharge pressure is about 6 bara (87 psia); the vapor mole fraction of the partially vaporized initial LNG at introduction to the distillation column is about 0.88; and the number of theoretical trays in the distillation column is 12, including 4 trays in a tower upper section, and 8 trays in tower lower section.

11. The process of claim 1 wherein due to increase in the temperature difference at the warm end of the heat exchanger the methane compressor discharge pressure decreases.

12. The process of claim 1 wherein said other stream is derived from said one enriched liquefied gas stream by separation in the column, and prior to said expansion of said other stream.

13. The process of claim 1 wherein said other stream is derived from said one stream, within the distillation column.

14. An apparatus for LNG enriching in methane by use of the methane cycle comprising:

a) a distillation column for separating a partially vaporized initial LNG stream into a methane enriched overhead gas stream and an ethane enriched bottom liquid stream (ethane product), or into a methane enriched overhead gas stream, an ethane enriched intermediate liquid stream (ethane product) and a propane-butane enriched bottom liquid stream (propane-butane product);

b) a reboiler for vaporizing the liquid that flows down in the distillation column;

c) a compressor for increasing the pressure of the methane enriched gas stream;

d) a heat exchanger for cooling and liquefying the compressed methane enriched stream through heating the removed from the distillation column methane enriched overhead gas stream and vaporizing the initial LNG stream;

e) a storage for the initial LNG;

f) a pump for increasing the pressure of the initial LNG;

g) a storage for the methane product;

h) a storage for the at least one of the following: x_1) ethane product, and x_2) storages for the ethane product and propane-butane product.

15. The apparatus of claim 14 including

i) a first expansion valve for expanding methane enriched liquid stream for introduction to the top of the distillation column,

ii) a second expansion valve for expanding another portion of improved methane enriched liquid stream, for use as a methane product.

16. The apparatus of claim 14 including control means to control said first and second valves to thereby control the distribution of said portions of the methane enriched stream.